

WHAT GENES in CURRENT BIOTECHNOLOGY CROPS?

Crop / trait	DNA source	About the gene	History in human food?
MAIZE			
Insect resistance	Cry1A(b) from <i>Bacillus thuringiensis</i> ("Bt"), a common soil bacterium	The Cry1A(b) gene encodes a crystalline protein which is toxic to lepidopteron insects. This gene is present as event Mon 810 or event Bt-11; event Bt176 is approved but no longer grown, thus, rare. Events using the same gene differ by site of insertion, copy number, or gene expression. Field testing selects the best events.	Yes. Bacteria are common in all foods, modern processed foods, traditional, or organic. <i>Bacillus thuringiensis</i> and related bacteria are found in soils world-wide. Human consumption is ancient
Herbicide resistance "Round-up Ready"	<i>Agrobacterium</i> gene encoding rare form of 5-enol-pyruvyl-shikimate-3-phosphate synthase EPSPS. Chloroplast transit peptide coding sequence.	EPSPS is an essential plant enzyme. Roundup-type herbicides (glyphosate) block EPSPS. The rare form of EPSPS is unaffected by glyphosate. Animals and humans do not have EPSPS at all, so are also not affected. EPSPS action involves photosynthesis which occurs in the chloroplast; the transit peptide sequence allows correct cellular placement of the transgene product.	Yes. Human consumption of <i>Agrobacterium</i> is ancient and common. EPSPS is naturally present in many foods. The rare form of EPSPS would have been eaten occasionally. Humans do not eat petunias. No known incident of harm from ingestion of this garden flower.
Herbicide resistance "Liberty Link"	Event T 25, the "bar" gene from <i>Streptomyces</i> ,	"Liberty"-herbicides (gluphosinate; "Basta") block plant nitrogen metabolism. "bar" encodes an enzyme that breaks down gluphosinate. Animals and humans do not have this form of nitrogen metabolism at all, so are not affected.	Yes. <i>Streptomyces</i> is found in all soils. Human consumption is ancient.
Regulation of gene expression	Rice gene promoter	Promoter: a DNA segment that functions like a volume switch. Promoter segments tell the cell the level to which the gene should be "turned on" (expressed). All genes have promoters.	Yes. Millennia of rice consumption, including the DNA for this promoter
Regulation of gene expression	<i>Agrobacterium</i> Nopaline synthase terminator segment	Gene termination sequence: a DNA segment that functions like a period after a sentence. Termination segments or terminators tell the cell where the gene stops. All genes have terminators*.	Yes. Human consumption is ancient and probably common because <i>Agrobacterium</i> is common around plants.
Marker genes	Soil bacteria (in some biotech maize)	Resistance to beta-lactamase antibiotics. <i>Early biotech methods used antibiotic resistance to separate successfully-transformed cells from background cells. Newer methods use other systems or remove the marker genes after the laboratory step.</i>	Yes. Human consumption at low levels is ancient because bacteria with antibiotic resistance are common in soils.
	None in Mon 810 biotech maize	Mon 810 Bt corn does not contain marker genes. The antibiotic resistance gene nptII (see Soybeans) was used to develop Mon 810 but was eliminated from final variety.	(no gene present)
SOYBEANS			
Herbicide resistance "Round-up Ready"	Same as in RR maize	Same as in RR maize	Same as for RR maize
Regulation of gene expression	Cauliflower mosaic virus CaMV25S promoter	See RR maize	Yes. Human consumption is ancient and frequent because CaMV is common on plants of the cabbage family.
	Terminator segment from <i>Arabidopsis thaliana</i>	See maize	Yes. <i>A. thaliana</i> is in the cabbage family. Human consumption of similar sequences from cabbage relatives is ancient and frequent.
Marker genes	Soil bacterium (strain used many years in laboratories)	Gene nptII encodes resistance to the antibiotic kanamycin. Kanamycin is not used in human internal medicine.	Yes. Human consumption at low levels is ancient-- bacteria with antibiotic resistance common in soils.

This table describes biotechnology varieties of maize and soya approved in the Europe Union as of Oct 2003.

*Other biotech crops currently approved in EU are herbicide (gluphosinate)-resistant swede rape (forage brassica); male sterile chicory, and carnation with improved vase life and flower color. Many other biotech crop varieties are under review. * This is the original and correct technical use of the term "terminator" in genetics. It is not to be confused with the same word as chosen, perhaps in ignorance, by an NGO as a negative description of an experimental bio-containment method*